

Metallic Crystal Defects and Irregular Geometries

Completed Technology Project (2013 - 2015)



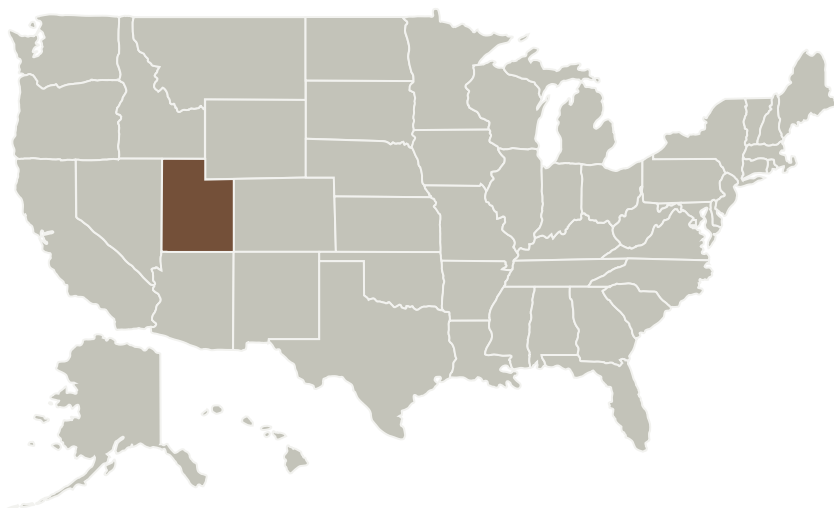
Project Introduction

Modern crystal plasticity methods take advantage of dislocation dynamics simulations to accurately model material deformation in support of computational materials design. However, there are presently no accurate and computationally efficient methods for modeling the stress and strain fields associated with dislocations in the vicinity of arbitrary free surfaces. This is a source of error in modeling dislocations for applications like MEMS, where small length scales and complex geometry make an infinite or semi-infinite assumption troublesome. This proposal is to develop mathematical and efficient computational techniques for modeling dislocations in elastic volumes of arbitrary shape. There are already published solutions for a few such cases (semi-infinite volumes, space between two parallel planes, etc.) and this study will seek to generalize those methods. These methods will be validated using atomistic simulations and electron microscopy on MEMS devices with well-characterized dislocation structures. Since dislocations are critical to both plasticity and failure modes in crystalline materials, this research has implications in computational design and failure prediction on subjects with length scales on the order of several microns and smaller.

Anticipated Benefits

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Primary U.S. Work Locations and Key Partners



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Responsible Program:

Space Technology Research Grants

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Organizations Performing Work	Role	Type	Location
Brigham Young University-Provo	Supporting Organization	Academia	Provo, Utah

Primary U.S. Work Locations

Utah

Project Website:

<https://www.nasa.gov/directorates/spacetech/home/index.html>

Project Management

Program Director:

Claudia M Meyer

Program Manager:

Hung D Nguyen

Principal Investigator:

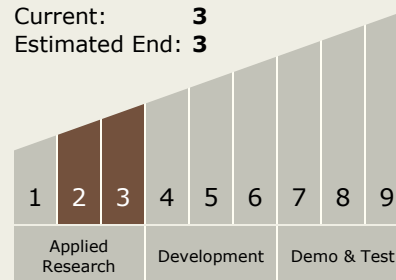
Eric Homer

Co-Investigator:

Thomas J Hardin

Technology Maturity (TRL)

Start: 2
Current: 3
Estimated End: 3



Technology Areas

Primary:

- TX09 Entry, Descent, and Landing
 - TX09.4 Vehicle Systems
 - TX09.4.5 Modeling and Simulation for EDL